
MAINTENANCE

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Some thoughts about Critical Thinking and its role in Maintenance

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Definition of Critical Thinking

Critical thinking is the intellectually disciplined process of actively, objectively analyzing, and skillfully conceptualizing, applying, synthesizing, and/or evaluating information and ideas, from, or generated by, observation, experience, reflection, reasoning, or communication while considering different perspectives and viewpoints, and evaluating arguments and evidence as a guide to form well-reasoned judgments or decisions.

Critical thinking involves questioning assumptions, challenging beliefs, and weighing the strengths and weaknesses of different arguments and sources of information entailing effective communication and problem-solving abilities.

It is a complex skillset that involves several different cognitive processes, including:

- **Clarifying:** Identifying the key elements of a problem or issue.
- **Analyzing:** Examining the evidence and arguments related to a problem or issue.
- **Evaluating:** Judging the credibility and relevance of the evidence and arguments.
- **Reasoning:** Drawing conclusions and making decisions based on the evidence and arguments.
- **Communicating:** Effectively presenting your conclusions and decisions to others.

Critical thinking is an essential skill for success in school, work, and life. It can help you to:

- Make better decisions.
- Solve problems more effectively.
- Communicate more effectively.
- Learn more effectively.
- Be more creative.
- Be more open-minded.

Humans are not Naturally Critical Thinkers.

We are born with a natural tendency to believe what we are told, and to trust our instincts. However, as we grow and develop, we learn to think more critically.

This tendency is due in part to our education, but it is also due to our own experiences and interactions with others in our space in the world.

There are several factors that can contribute to the development of critical thinking skills, including:

- **Education:**
Critical thinking skills are often taught in schools and universities. However, it is important to note that education is not the only factor that contributes to the development of critical thinking skills.
- **Experience:**
As we grow and experience the world, we learn to think more critically. This is because we are exposed to a wider range of information and ideas, and we are forced to make more decisions.
- **Interactions with others:**
When we interact with others, we are exposed to different perspectives and ways of thinking. This can help us to question our own beliefs and to think more critically about the information that we are presented with.

Influencing Factors of Critical Thinking

There are several life factors that can influence the development and outcome of a person's critical thinking skills. These include:

- **Education:**
Formal education can provide individuals with the knowledge and skills necessary for critical thinking, such as analytical and problem-solving abilities.
- **Culture and environment:**
These influences surrounding an individual can shape their perspective, beliefs, and values, which can affect their critical thinking skills.
- **Personal experiences:**
Past experiences can shape an individual's worldview, which can impact their ability to critically analyze information and make informed decisions.
- **Cognitive abilities:**
Factors such as intelligence, memory, and attention can all play a role in a person's ability to engage in critical thinking.
- **Emotional intelligence:**
Emotional intelligence, including self-awareness and empathy, can help individuals consider different perspectives and avoid biases in their critical thinking.
- **Motivation:**
A person's level of motivation to engage in critical thinking can impact their ability to do so effectively.
- **Practice:**
Like any skill, critical thinking requires practice to improve. Consistent engagement in activities that require critical thinking can enhance one's abilities over time.

These factors interact with each other and can affect a person's critical thinking skills in different ways. However, with effort and practice, anyone can improve their critical thinking abilities. Without these experiences, it is difficult for humans to develop effective critical thinking skills.

For example, a child who has never been exposed to different cultures or ways of thinking may be more likely to believe what they are told without question. They may also be more likely to make decisions based on emotion or impulse, rather than on logic and reason.

Personally, I remember being encouraged by my 3rd or 4th grade teacher to think through problems she presented to the class and an epiphany moment occurred. Later in 12th grade my mandatory IQ test required in the state, revealed I should make 'teaching' or commercial 'airline pilot' a job goal, which reflected upon today indicates that even back then IQ tests were designed with some critical thinking response required.

Teaching involves a variety of critical thinking skills, such as analyzing student performance data, designing effective lesson plans, and evaluating educational materials. Teachers must also be able to adapt their teaching methods to meet the needs of individual students and adjust their approach based on feedback and outcomes and continuously learn as life progresses.

Commercial airline pilots must also have strong critical thinking skills and continuously learn, particularly when it comes to decision-making in high-pressure situations. Pilots must be able to evaluate multiple sources of information, analyze data, and make informed decisions quickly and accurately and adapt to new technologies and processes.

Both teaching and commercial airline pilot are professions that require a combination of technical knowledge, practical skills, and critical thinking ability. The fact that these two professions were identified as potential job positions based on my IQ test results suggests that I might have strengths in these areas, including critical thinking.

As we grow and experience the world, we learn to think more critically. This is because we are exposed to a wider range of information and ideas, and we are forced to make more decisions. We also learn to interact with others and to consider their perspectives. This helps us to develop our critical thinking skills and to become more open-minded and informed.

Early in my career, as a Maintenance Manager, I recognized that problem-solving was an important attribute to possess so I attended a weeklong class, clear across the country, to learn about Troubleshooting. That experience forever changed my perspective and established a behavior I still cherish today.

Without these experiences, it is difficult for humans to develop effective critical thinking skills. We may be more likely to believe what we are told without question, to make decisions based on emotion or impulse, and to be closed-minded to new ideas.

This is why it is important for children to be exposed to different cultures and ways of thinking from a young age. It is also important for adults to continue to learn and grow, so that they can keep their critical thinking skills sharp.

Developing Skills for Critical Thinking

Here are some tips for developing critical thinking skills:

- Be open-minded and willing to consider different perspectives.
- Ask questions and seek out information.
- Be skeptical of information that is presented to you without evidence.
- Be aware of your own biases and prejudices.
- Be willing to change your mind when presented with new evidence.

Interrelated Skills are Required for Critical Thinking

Critical thinking is not just a single skill, but a set of interrelated skills and cognitive processes that build upon each other.

Younger individuals, as I mentioned from my own experience, have a greater capacity for neuroplasticity, meaning their brains are more malleable and adaptable, making it easier for them to develop new skills and learn new ways of thinking¹.

As we age, unfortunately, our neural pathways become more established and rigid, making it more difficult to develop new cognitive processes.

Critical thinking skills taught and reinforced during formal education, again as mentioned, may not have the foundation necessary to build upon later in life if an individual did not receive adequate instruction and encouragement during their school years,

The key is to be motivated, persistent, and willing to put in the effort to develop these important skills and in my case, being in the asset care management business, committed to making 'the place run better', those success keys were ever present.

Acquiring critical thinking skills later in life requires a combination of factors, repeating myself I know, but repetition is the mother of learning:

- **Motivation:**
A strong desire to develop critical thinking skills and a willingness to put in the time and effort necessary to learn and practice these skills. My goal was to solve problems that were keeping me and others in the mill, so I could have a life.
- **Persistence:**
Developing critical thinking skills requires consistent effort over time. Being persistent and not giving up when faced with challenges or setbacks is essential.
- **Practice:**
Regular practice is crucial to developing critical thinking skills. This may involve engaging in activities that challenge your thinking, such as solving puzzles, engaging in debates, or analyzing complex problems, all of which I practiced regularly, and still do.
- **Exposure to diverse perspectives:**
Critical thinking involves considering multiple perspectives and being open to different points of view. This is the hard part, so I made it a practice to seek out diverse perspectives and engaging in discussions with people who have different viewpoints based upon their experiences helping me broaden my thinking and challenge my assumptions.
- **Intellectual curiosity:**
A natural curiosity about the world around you and a desire to learn new things is helpful in developing critical thinking and many know that my so-called 'gofer' years were filled with opportunities to fill this void. Being curious and asking questions can help expand your thinking and challenge your assumptions.
- **Self-awareness:**
Understanding your own biases, assumptions, and limitations is critical to developing critical thinking skills. Being self-aware and reflective can help you identify areas where you need to

¹ https://www.linkedin.com/posts/john-yolton-49ab24_the-journey-begins-the-lessons-unfold-activity-7049146732756045824-Dzoe?utm_source=share&utm_medium=member_desktop

improve and avoid common thinking traps. Again, my early years were filled with events that helped shape this characteristic. Growing up in a rural area that suddenly has 15,000 new families to assimilate creates instantaneous challenges to the region's embedded mores, behaviors, beliefs.

- **Continuous learning:**

Critical thinking skills require continuous learning and development. Being open to learning new things and seeking out new experiences can help you continue to develop your thinking skills over time. One must accept and embrace the fact that change itself implies that what you have learned up to that point is never going to prepare you for the future.

Cultivating these success factors early in life can help develop critical thinking skills later in life and improve their ability to analyze information, solve problems, and make informed decisions adding great value to your career goals.

Learning Opportunities for Critical Thinking

There are many continuous learning opportunities available to individuals seeking to improve their critical thinking skills, including:

- **Online courses:**

There are a variety of online courses available that focus specifically on critical thinking skills. Platforms such as Coursera, edX, and Udemy offer courses on topics such as logic, problem-solving, and decision-making.

- **Professional development workshops:**

Many organizations offer workshops and training sessions that focus on developing critical thinking skills. These workshops may be targeted towards specific industries or professions. As mentioned, I was fortunately early in my career to attend a 'Problem-solving' workshop which changed my perspective, e.g., putting a scientific process into a thought process.

- **Books and publications:**

There are many books and publications available that focus on critical thinking skills. Some popular titles include "Thinking, Fast and Slow" by Daniel Kahneman, "The Art of Thinking Clearly" by Rolf Dobelli, and "The Critical Thinking Toolkit" by Galen A. Foresman. I must admit, though, that my early life reading of science-fiction novels formed the basis of my critical thinking experiences, e.g., 'Can this be possible?'

- **Discussion groups and clubs:**

Joining a discussion group or club focused on critical thinking can provide opportunities to engage in thoughtful discussions and debates with like-minded individuals. As an active member of TAPPI's Mill Maintenance and Engineering technical group we regularly attended a well-attended, open session of maintenance and mill engineering related subjects discussing current issues and from this 'sub-committees' were formed to continue the critical thinking/continuous learning process to some sort of consensus conclusion.

- **Experiential learning:**

Participating in activities that require critical thinking, such as solving puzzles, playing strategy games, or analyzing complex problems, can provide opportunities to practice and develop critical thinking skills. Perhaps the greatest contributor for me was learning and actively engaging in the game of chess, and later Bridge. Both are a lot more than games. To be successful and competitive, critical thinking must be applied, constantly.

- **Academic programs:**

Pursuing a degree or certification program in a field that requires strong critical thinking skills, such as law, philosophy, or business, can provide a structured environment for developing these

skills. The number of programs developed in recent decades specifically for asset care management, or risk management all dwell on the critical thinking component of success.

- **Mentoring:**
Working with a mentor who has strong critical thinking skills can provide valuable guidance and support in developing your own skills. Yet again, I was extremely fortunate to have a career filled with experienced mentors influencing the way my thoughts progressed².

Responsibilities Requiring Critical Thinking

- **Management consultants:**
Management consultants are hired by organizations to help solve complex problems and make strategic decisions. They need strong critical thinking skills to analyze data, evaluate options, and develop recommendations.
- **Lawyers:**
Lawyers must analyze complex legal issues, weigh evidence, and make arguments based on logic and reason. They need strong critical thinking skills to effectively represent their clients.
- **Data analysts:**
Data analysts work with large amounts of data to identify trends and patterns. They need strong critical thinking skills to analyze the data and draw meaningful insights.
- **Engineers:**
Engineers must use critical thinking skills to design and develop new products and technologies. They need to analyze data, solve complex problems, and evaluate different design options.
- **Scientists:**
Scientists need strong critical thinking skills to design and carry out experiments, analyze data, and draw conclusions. They must be able to evaluate evidence and draw logical conclusions based on their findings.
- **Teachers:**
Teachers must be able to analyze student performance data, identify areas for improvement, and develop effective teaching strategies. They also need strong critical thinking skills to evaluate educational materials and design effective lesson plans.
- **Healthcare professionals:**
Healthcare professionals, such as doctors and nurses, must analyze patient data, diagnose illnesses, and develop treatment plans. They need strong critical thinking skills to make informed decisions and provide effective care.
- **Asset Care professionals:**
This group is very similar to Healthcare; Data analysis, Diagnosis, Prognosis, Development of mitigation plans while treating/correcting.

² https://www.linkedin.com/posts/john-yolton-49ab24_some-folks-are-naturally-gifted-for-mentoring-activity-7048351732216590336-HZRO?utm_source=share&utm_medium=member_desktop

https://www.linkedin.com/posts/john-yolton-49ab24_win-win-the-old-fashioned-way-activity-6863178477093445632-gRLO?utm_source=share&utm_medium=member_desktop

In general, any job that involves problem-solving, decision-making, or analyzing complex information will require some level of critical thinking ability.

Maintenance Management is a Perfect Role for Critical Thinkers

As a maintenance manager, for example, you are responsible for overseeing the maintenance of equipment, machinery, and other assets. This requires you to analyze data, identify trends and patterns, and make informed decisions about maintenance schedules, repair procedures, and replacement strategies.

To be an effective maintenance manager, you must also be able to analyze problems, identify root causes, and develop solutions that address the underlying issues. This involves a range of critical thinking skills, such as deductive reasoning, problem-solving, and decision-making.

In this asset care management specialist role, you manage the lifecycle of an organization's assets, including maintenance, repair, and replacement. This requires you to analyze data on asset performance, evaluate the effectiveness of maintenance strategies, and develop plans to improve asset performance over time on a continuous basis.

Success in this role requires you to be able to analyze complex data sets, identify trends and patterns, and make informed decisions based on your findings. You must also be able to develop effective strategies for managing assets that consider a range of factors, such as budget constraints, resource availability, and operational requirements. The job position requires strong critical thinking skills to effectively manage assets, including the workforce, and ensure optimal performance over time.

Work responsibilities of Maintenance Management that require critical thinking include:

- **Problem-solving:**
Analyzing complex problems, identifying potential solutions, and evaluating the effectiveness of different options.
- **Decision-making:**
Weighing different options and considering the consequences of each decision before making a final choice.
- **Strategic planning:**
Developing long-term plans and goals, anticipating potential challenges, and adjusting plans as needed.
- **Data analysis:**
Collecting and interpreting data to inform decisions and solve problems.
- **Risk assessment:**
Identifying potential risks and developing strategies to mitigate or manage them.
- **Innovation:**
Generating new ideas, products, or services that meet the needs of customers or improve business processes.
- **Project management:**
Coordinating resources, timelines, and tasks to ensure projects are completed efficiently and effectively.

- **Team collaboration:**
Communicating effectively with colleagues and working collaboratively to solve problems and achieve goals.
- **Leadership:**
Inspiring and motivating others, delegating tasks effectively, and making difficult decisions that impact the organization.
- **Customer service:**
Understanding the needs of customers, in my case, operations and providing effective solutions to their problems or concerns.

Here are some of the reasons why critical thinking is so important in the workplace, when you can think critically it helps you:

- **Make better decisions.**
You are better able to gather information, weigh the pros and cons of different options, and make a decision that is based on logic and reason.
- **Solve problems more effectively.**
You are better able to identify the root cause of a problem, generate potential solutions, and evaluate the pros and cons of each solution.
- **Communicate more effectively.**
You are better able to gather your thoughts, organize your ideas, and communicate them concisely and clearly.

I cannot help but to think back to my early days in my first maintenance management position, Assistant Maintenance Manager, when I use to field a lot of calls from the off-shift hours operations supervisors, or from the designated maintenance supervisor on call, to alert me that there was a 'problem'.

I usually went to the job site first and then headed to the 'technical resource center', the filing cabinets and Kardex files in the maintenance office. There I would search for any information about the assets, e.g., manuals, letters, past issues and who worked on them, etc.

Then I would go back to the incident site and question those present, seeking any additional information from those on site and working the job.

That routine enabled me to make better, well-informed decisions, if one was required, and certainly helped with the problem-solving aspect, but it also prepared me for the inevitable follow-up conversations and, usually, in that era, finger-pointing discussions.

Critical thinking is a valuable skill that can help you to succeed in any job position. If you are looking for a job where you can use your critical thinking skills, consider one of the job positions listed above.

Characteristics of Critical Thinking

Many human characteristics that can predetermine a person's critical thinking capability. Some of the most important include:

- **Motivation.**
Critical thinking requires motivation to invest the time and effort necessary to think carefully about problems and issues. People who are motivated to learn and grow are more likely to develop strong critical thinking skills.
- **Open-mindedness.**

Open-mindedness is essential for critical thinking. People who are open-minded are willing to consider new ideas and perspectives, even if they conflict with their own beliefs.

- **Intellectual humility.**
Intellectual humility is the ability to recognize one's own limitations and to be open to the possibility that one is wrong. People who are intellectually humble are less likely to make rash judgments or to be swayed by their emotions.
- **Resilience.**
Critical thinking can be challenging, and it is important to be able to persevere in the face of setbacks. People who are resilient can bounce back from failure and keep learning and growing.

While some people may be naturally more gifted at critical thinking than others, everyone can develop these skills through practice and effort.

Non-critical thinking: A maintenance manager who is not thinking critically might see a broken machine and not take the time to investigate the root cause of the problem, or to consider whether there is a way to repair the machine instead of replacing it which can lead to unnecessary costs and waste.

Critical thinking: A maintenance manager who is thinking critically would first investigate the root cause of the problem, consider all the possible solutions, and weigh the pros and cons of each one, factoring the long-term costs and benefits of each solution, deciding to repair the machine instead of replacing it if it is cost-effective to do so.

Again, referencing the time frame mentioned above, ANSI standard pumps were becoming more and more the preferred equipment replacing purpose designed pumps for each medium being pumped. This ANSI standard included back pull-out rotating elements that could easily be replaced if the volute was still within the service factor. This allowed a transition from replacing parts of a purpose designed to partial replacement and then repair of the removed rotating element, at leisure. A huge cost savings and prevention of extended downtime for repairs.

Critical thinking is essential for effective maintenance management identifying and solving problems more efficiently and making better decisions about how to allocate resources.

Other examples of a maintenance manager/supervisor/planner/engineer who is thinking critically include:

- Will not just follow the manufacturer's recommended maintenance schedule but also consider the specific conditions of their equipment and the environment in which it operates.
- Will not just rely on their own experience and knowledge but also seek out and consider the advice of others.
- Will not be afraid to challenge the status quo. If they believe that there is a better way to do something, they will be willing to try it.

Maintenance Workers Should be Critical Thinkers

Critical thinking is a valuable skill for anyone working in maintenance.

I have written about this in the past³, but again highlighting the value of a shift mechanic, as an example, with critical thinking skills here are some attributes that should be sought for a maintenance shift mechanic:

- **Technical skills:**
A maintenance shift mechanic must have the technical skills to diagnose and repair a variety of equipment. This may include electrical, mechanical, and lubrication skills.
- **Problem-solving skills:**
A maintenance shift mechanic must be able to quickly identify and solve problems. They must be able to think on their feet and come up with creative solutions.
- **Communication skills:**
A maintenance shift mechanic must be able to communicate effectively with both technical and non-technical people. They must be able to explain complex technical concepts concisely and clearly and often with someone with more authority.
- **Teamwork skills:**
A maintenance shift mechanic must be able to work effectively as part of a team. They must be able to coordinate their work with other mechanics and support staff.
- **Work ethic:**
A maintenance shift mechanic must be willing to work long hours and weekends. They must also be able to work in a variety of conditions, including heat, cold, noise, distractions.

Maintenance shift mechanics should also be:

- **Safety-conscious:**
A maintenance shift mechanic must be aware of the potential hazards associated with their work and take steps to prevent accidents.
- **Reliable:**
A maintenance shift mechanic must be able to show up for work on time and be prepared to work.
- **Professional:**
A maintenance shift mechanic must be able to represent the maintenance function in a positive way to operations and other stakeholders.

By seeking out candidates with these attributes, you can increase your chances of finding a qualified maintenance shift mechanic who can help to keep your equipment running smoothly and efficiently.

For example, a shift mechanic might need to:

- Identify the root cause of a problem.
- Develop a plan to fix the problem.
- Order the necessary parts.
- Repair the equipment.
- Test the equipment to make sure it is working properly.

³ https://media.licdn.com/dms/document/C561FAQFtZFvJwPdhpA/feedshare-document-pdf-analyzed/0/1648406013921?e=1683158400&v=beta&t=6bpwfMngOC4EWHWtBnIXJ7Jo-rF6y69_67XaP0h4j9w

Critical thinking is essential for all these tasks so a shift mechanic can:

- Avoid making costly mistakes.
- Save time and money.
- Improve the quality of their work.
- Provide better customer service.

Fortunately, critical thinking can be taught and learned, and it is a skill that can be developed through practice and experience.

Teaching Critical Thinking

There are many ways to teach critical thinking. One common approach is to use Socratic questioning. This involves asking questions that challenge assumptions and help think more deeply about the issue at hand.

Another approach is to provide opportunities to practice solving problems and making decisions. This can be done through simulations, role-playing exercises, and real-world projects. One of the reasons is you will find past failure objects displayed in maintenance offices.

Some tips for teaching critical thinking include:

- **Model critical thinking behavior.**
Beginners learn by watching the experienced veterans in their lives. If you want your new employees to think critically, you need to model critical thinking behavior yourself. This means asking questions, considering different perspectives, and being open to new ideas.
- **Provide opportunities for practice.**
The best way to learn critical thinking is to practice it. Give your employees opportunities to solve problems, make decisions, and think critically about the world around them.
- **Challenge assumptions.**
One of the most important aspects of critical thinking is the ability to challenge assumptions. Help your employees to see that there are often multiple perspectives on an issue, and that not all information is created equally.
- **Be patient.**
Critical thinking is a skill that takes time to develop. Don't expect your new employees to be critical thinkers overnight. Be patient and provide them with the support they need to learn and grow.

Strategic Thinking is not Critical Thinking

Chess, the game, is a tool for teaching and learning critical thinking requiring players to think strategically, plan, and make decisions under pressure. These are all important skills for critical thinking.

In chess, players must constantly assess the situation and make decisions based on the information they have available. They must also be able to think ahead and anticipate their opponent's moves. This requires players to be able to think logically and to solve problems.

Chess also teaches players to be patient and to persevere, while it can be frustrating players must learn to keep trying even when they are losing thus demonstrating, in a game, the importance of resilience and the value of hard work.

Critical thinking and strategic thinking are both important skills, but they are not the same.

- **Critical thinking** is the ability to think clearly and rationally about a problem or issue.
- **Strategic thinking** is the ability to develop a plan of action to achieve a goal.

Critical thinking is, however, essential for strategic thinking, e.g., to develop a successful strategy, you need to be able to think critically about the situation and identify all the potential risks, challenges, and able to think creatively and come up with new ideas.

Strategic thinking is also essential for critical thinking.

Once you have developed a strategy, you need to be able to think strategically about how to implement it. This involves being able to think ahead and anticipate potential problems. You also need to be able to be flexible and adapt your strategy as needed.

Management by Wandering (MBW) a Critical Thinking Opportunity

When managers wander around their sites, they can see things from the perspective of the employees, what is working well and what is not and where there are opportunities for improvement.

MBW can also help managers to build relationships with the employees, taking the time to walk around and talk to employees, shows interest in the work and values employee contributions.

MBW can identify potential problems.

When managers, among many others at a site, are out and about, they are more likely to hear about the small problems before they become big issues thus giving whomever the opportunity to address problems early on, before those problems have a chance to cause major disruptions.

Here are some tips for managers who want to use MBW effectively:

- **Be prepared.**
Before you start wandering around, take some time to think about what you want to achieve. What do you want to see? What do you want to learn?
- **Be open-minded.**
When you're wandering around, be open to new ideas and perspectives. Don't just listen to what your employees are saying, but also listen to what they're not saying.
- **Be respectful.**
Remember that you're in their space. Be respectful of their time and their work.
- **Be patient.**
It takes time to build relationships and trust. Don't expect to see results overnight.

While valuable MBW is not a magic bullet. It takes time, effort, and patience to be effective. But if you're willing to put in the work, MBW can help you to improve your critical thinking skills and make better decisions.

I have written several articles about MBW events in my past simply because it is a very effective tool.⁴

The inherent prerequisites of critical thinking are the skills and abilities that are necessary for critical thinking to occur. These prerequisites include:

- **Intellectual curiosity:** Critical thinkers are naturally curious about the world around them. They are always asking questions and seeking out new information.
- **Open-mindedness:** Critical thinkers are open to new ideas and perspectives. They are not afraid to challenge their own beliefs and to consider new ways of thinking.
- **Logic and reasoning:** Critical thinkers can think logically and reason through problems. They can identify assumptions and biases and draw sound conclusions.
- **Problem-solving skills:** Critical thinkers can identify and solve problems. They can think creatively and come up with new solutions.
- **Communication skills:** Critical thinkers can communicate their ideas clearly and effectively. They can listen to others and consider their perspectives.

These are just some of the inherent prerequisites of critical thinking. By developing these skills and abilities, you can improve your ability to think critically and make better decisions.

Here are some additional tips for developing your critical thinking skills:

- **Read widely and often.** The more you read, the more you will be exposed to different ideas and perspectives. This will help you to develop your open-mindedness and to challenge your own beliefs.
- **Talk to people from different backgrounds.** Getting to know people from different backgrounds will help you to understand different perspectives and to see the world in new ways.
- **Ask questions.** Don't be afraid to ask questions, even if you think they are stupid. The more you ask questions, the more you will learn.
- **Be willing to change your mind.** If you are presented with new information that challenges your beliefs, be willing to change your mind. This is a sign of intellectual maturity.
- **Be patient.** Critical thinking takes time and effort. Don't expect to become a critical thinker overnight. Just keep practicing and you will eventually get better at it.

Here are some steps that a person can pursue to become a critical thinker:

- **Become aware of your own biases.** Everyone has biases, but it's important to be aware of them so that you can avoid letting them cloud your judgment.
- **Be open to new ideas and perspectives.** Don't be afraid to challenge your own beliefs and to consider new ways of thinking.
- **Ask questions.** Don't be afraid to ask questions, even if you think they are stupid. The more you ask questions, the more you will learn.
- **Be willing to change your mind.** If you are presented with new information that challenges your beliefs, be willing to change your mind. This is a sign of intellectual maturity.
- **Be patient.** Critical thinking takes time and effort. Don't expect to become a critical thinker overnight. Just keep practicing and you will eventually get better at it.

⁴ https://www.linkedin.com/posts/john-yolton-49ab24_reliability-success-requires-three-elements-activity-7052358959621435392-GD_s?utm_source=share&utm_medium=member_desktop

https://www.linkedin.com/posts/john-yolton-49ab24_sometimes-by-accident-opportunities-are-activity-6943241424054149121-7kEs?utm_source=share&utm_medium=member_desktop

Here are some additional tips I've found, from my experience, including global travel to industrial sites, for developing your own critical thinking skills:

- **Read widely and often.**
The more you read, the more you will be exposed to different ideas and perspectives. This will help you to develop your open-mindedness and to challenge your own beliefs.
- **Talk to people from different backgrounds.**
Getting to know people from different backgrounds will help you to understand different perspectives and to see the world in new ways.
- **Take a critical thinking class.**
There are many critical thinking classes available online⁵ and in person. Taking a class can help you to learn the basics of critical thinking and to develop your skills.
- **Practice critical thinking in your everyday life.**
The more you practice critical thinking, the better you will become at it. So, try to think critically about everything you do, from making decisions to solving problems.

Humility for Critical Thinking

Being humble is also an element of becoming a critical thinker. Critical thinkers, typically, are open to new ideas and perspectives, and are willing to change their minds if presented with new information. They are also aware of their own biases and are careful not to let biases cloud their judgment.

Humility is important for critical thinking because it allows people to be open to new ideas and perspectives. When people are humble, they are not afraid to admit that they do not know everything. They are also willing to listen to others and to consider their ideas. This openness to new ideas is essential for critical thinking because it allows people to learn and to grow.

In addition, humility is important for critical thinking because it helps people to be aware of their own biases. When people are humble, they are not afraid to admit that they have biases. They are also willing to challenge their own beliefs and to consider new ways of thinking.

Data Seeking a Key Requisite of Critical Thinking

Data seeking and acquisition is another element of critical thinking. Critical thinking is the process of evaluating information and forming judgments based on evidence and logic. It is about being able to think clearly and rationally about a problem or issue.

To think critically, it is important to have access to accurate and reliable information. This is where data seeking, and acquisition comes in. As mentioned above, data seeking is the process of identifying and locating relevant information. Data acquisition is the process of collecting and storing information made much easier in the last few decades with digitization, relational databases and applications, CMMS for example, designed for the purpose.

While there are many different sources of data, including books, articles, websites, and databases, it is important to be able to identify and evaluate the quality of different sources of data. Some sources of data are more reliable than others. It is also important to be aware of the biases that may exist in different sources of data.

⁵ <https://www.coursera.org/courses?query=critical%20thinking>

Once you have identified and acquired relevant data, you can then use it to form judgments and make decisions. It is important to be able to think critically about the data and to consider all the possible interpretations while also being able to identify and avoid logical fallacies.

Data seeking and acquisition is an essential part of critical thinking. By gathering accurate and reliable information, you can improve your ability to think clearly and rationally about a problem or issue.⁶

Here are some tips for effective data seeking and acquisition:

- **Identify your needs.**
What information do you need to answer your question or solve your problem?
- **Do your research.**
Search for information from a variety of sources, including books, articles, websites, and databases.
- **Evaluate the quality of your sources.**
Consider the source's credentials, the purpose of the source, and the date of publication.
- **Be aware of bias.**
No source of information is completely unbiased. Consider the potential biases of your sources and be sure to weigh all sides of an issue before forming an opinion.
- **Take notes.**
As you gather information, take notes to help you keep track of your sources and to organize your thoughts.
- **Combine your findings.**
Once you have gathered a variety of sources, take some time to group your findings and to draw conclusions.
- **Be open to new information.**
Be willing to change your mind if you are presented with new information that challenges your current beliefs.

By following these tips, you can improve your ability to seek and acquire data effectively. This will help you to think more critically about the world around you and to make better decisions.

Social Interaction for Critical Thinking

Social interaction can be an element of critical thinking. When we interact with others, we are exposed to different perspectives and ideas. This can help us to challenge our own beliefs and to think more critically about the world around us.

For example, if we are only exposed to people who share our same beliefs, we may never be challenged to think critically about those beliefs. However, if we interact with people who have different beliefs, we

⁶ https://www.linkedin.com/posts/john-yolton-49ab24_improvement-can-be-applied-to-faulty-processes-activity-7008564241943187456-QCUO?utm_source=share&utm_medium=member_desktop

https://www.linkedin.com/posts/john-yolton-49ab24_case-history-of-a-real-manufacturing-site-activity-6876245715249569792-tvBY?utm_source=share&utm_medium=member_desktop

may be forced to consider our own beliefs more carefully. This can help us to develop more nuanced and sophisticated understandings of the world.

In this regard I've been very fortunate in my career with multiple locations of work and with foreign companies. These experiences enable me to observe the subtleties of different cultures, beliefs, behaviors, and the effect on the workplace⁷.

In addition, social interaction helps us to develop our critical thinking skills in other ways, for example, when explaining our ideas to others, thinking about them more carefully and being able to respond to challenges and objections.

Role Playing for Critical Thinking

Role playing is a technique that is used to help people think more critically about a situation involving taking on the role of someone else and trying to see the world from their perspective. This can help people to understand different points of view and to consider alternative solutions to problems.

There are many ways to role play.

One way is to simply imagine yourself as someone else and to think about how you would react in a particular situation based upon the responsibilities of the role. Another way is to act out a role-playing scenario with another person.

For effective role playing:

- **Choose a role (responsibility) that you are interested in exploring.**
This will help you to stay engaged in the role-playing exercise.
- **Be open to new perspectives.**
The goal of role playing is to learn about different points of view. So, be willing to put yourself in someone else's shoes and to see the world from their perspective.
- **Be willing to challenge your own beliefs.**
Role playing can help you to identify your own biases and assumptions. So, be willing to challenge your own beliefs and to consider alternative points of view.
- **Be patient.**
Role playing can take some time to get used to. So, be patient with yourself and with others.

Behaviors of Critical Thinking

Here are some other examples of behavior that can help you become a critical thinker:

- **Be curious.**
Ask questions and seek out new information.
- **Be open-minded.**
Be willing to consider different perspectives and ideas.
- **Be willing to change your mind.**

⁷ https://www.linkedin.com/posts/john-yolton-49ab24_when-seeking-root-cause-examine-everything-activity-6861010908102180864-RyM8?utm_source=share&utm_medium=member_desktop

If you are presented with new information that challenges your beliefs, be willing to change your mind.

- **Be honest.**
Be truthful in your thinking and in your communication.
- **Be fair.**
Give everyone a fair hearing, even if you disagree with them.
- **Be respectful.**
Treat others with respect, even if you disagree with them.
- **Be patient.**
Critical thinking takes time and effort. Don't expect to become a critical thinker overnight.
- **Be persistent.**
Don't give up on critical thinking, even when it's difficult.

By following these tips, you can improve your critical thinking skills and become a more effective thinker which in turn will provide more effective decisions which will improve your career opportunities.

Sorry for the disjointedness of this narrative, someday, when I have the time and inclination, I will 'clean' it up with context editing but these were jotted down thoughts about the extremely important subject, from my perspective, that contributed greatly to my career and my career opportunities.

You may know all of this, and you may have thought about this subject at length, so I am stating the obvious, but there may be one, perhaps even two of you who have not spent some time reflecting upon this subject and this is offered as one man's perspective.

Careers are built on others' wisdom and personally I have read, observed, listened, been mentored, instructed, and learned from many whom I admire, some are still vertical, many that are not. Thank you all.